**Before the**
**Federal Communications Commission**
**Washington, DC. 20554**

| | | |
|---|---|---|
| **In the Matter of** | ) | |
| | ) | |
| **Inquiry Regarding Carrier** | ) | **ET Docket No. 03-104** |
| **Current Systems including** | ) | |
| **Broadband over Power Line Systems** | ) | |
| | ) | |

To: The Office of Engineering and Technology

**REPLY COMMENTS of Alfred T. Lorona**
**to various Comments submitted by Cinergy, Southern LINC, POWERWAN, Main.net, et al.**

Alfred T. Lorona, representing self, respectfully submits these reply comments both to make general observations about and in response to various comments submitted in the matter of Inquiry Regarding Carrier Current Systems including Broadband over Power Line Systems (ET Docket No. 03-104).

## Summary

I have now read nearly one hundred comments both for and against BPL. It is striking that, almost to a person, the comments in favor of BPL are largely broad statements about the proposed benefits of the new technology, while the arguments against BPL are predominantly physics-, engineering theory-, and measurements-based. It is boiling down to a struggle between lofty claims without a real basis in physics in the face of physical realities that simply preclude what BPL would like to accomplish.

As readers review the comments of companies in favor of BPL, they must find themselves asking, “Where’s the beef?”

The overwhelming weight of the data is against them; yet BPL proponents have produced little or no data of their own to back the numerous claims in their filed comments.

## General Observations

In the normal course of events, you wouldn't ask an electronics engineer for legal advice.

Conversely, when hard data describing an electrical, mechanical, or physical phenomenon are needed, it would be a highly questionable practice to consult, say, an attorney — without at least giving him or her a foundation of facts, measurements and observations from which to draw conclusions. Yet, in the current situation we have many comments filed by noticeably non-technical people representing power utilities, semiconductor manufacturers, and service providers that simply do not address a central question surrounding BPL: whether it is a source of harmful interference.

The first observation to be made about the comments filed in the matter of ET Docket No. 03-104 is the impressive and thorough research on behalf of many opponents of BPL— many of whom are technology professionals and who claim that BPL systems cause harmful interference and apparently have the facts to back up these claims— in stark contrast to the dearth of physical evidence in the proponents' filings to refute the harmful interference claims.

The second observation to be made is to note the statements by several companies that BPL trials have already been conducted. These trials are " ongoing" , in the case of Cinergy[1], or have been conducted " since the year 2000" in the case of POWERWAN[2], yet scarcely any hard data from these trials was made public. Instead, the FCC is asked by various parties to relax the Part 15 limits in a variety of ways in order to ease the development of BPL, but apparently without any evidence made public about the measured radiation from BPL systems. That is certainly odd practice. I worry about Access BPL's chance of success, very frankly, operating as it is in virtual oblivion as to its potential for creating harmful interference.

With the possible exception of POWERWAN, which makes provocative claims about being able to notch out certain parts of the spectrum in order to minimize interference, the BPL proponents seem totally unaware of the need to apply scientific methods to determine how In-House and Access BPL will affect other (licensed) services and how they will be affected by other (licensed) services.

The third interesting observation is to note that the numbers citing the BPL data rates are all over the map. In a casual investigation of the comments these numbers ranged from " 250 - 500 kb/s on the low end," (Southern LINC[3] et al.); to " greater than 2 Mb/s"

(Cinergy); to " greater than 1 Mb/s typical" and " 100 Mb/s maximum" (POWERWAN). That is an enormous spread. What the parties don't generally tell us is why the rates varied, what conditions caused a particularly high or low data rate, whether the rates were symmetrical, how the measured interferenced changed with different data rates, whether the higher rates were achieved with no increase in transmitter power, what effect the number of users had on the data rate, whether the BPL system was tested with interfering signals in the vicinity and how it responded to those signals, whether the users were satisfied with the resultant performance in the presence of interferers, what effect the type of dwelling, length and type of electrical service drop had on the data rate, what the attenuation was through the utility transformer and how it was overcome, whether time of day, year, or solar activity had any effect, or any other related information.

On the other hand, the comments from BPL opponents are frequently filled with actual results of conducted and radiated emissions field tests, web links to audio and video recordings of live measurements in the BPL trial areas, computation of field strengths, noise levels, and signal-to-noise ratio degradation, spectrum measurements, and so forth[4]. The contrast is truly astonishing.

## POWERWAN

The comments by POWERWAN are particularly revealing, if for no other reason than they come as close to a complete and factual report as can be found in the pro-BPL camp. There are two conclusions one can draw from them:

1. POWERWAN claims that it can insert a notch or notches into their BPL signal to protect certain users of the HF spectrum. In particular, amateur radio operators are mentioned as a licensed service needing protection from BPL. If this is so, then this technology deserves very special attention. It could prove quite useful.

2. That POWERWAN evidently understands the situation and intends to implement this technology confirms what anti-BPL people have been saying: that BPL poses a harmful interference risk. POWERWAN is obviously aware of this and is taking mitigating measures. Perhaps others are doing the same, but the point is we don't know simply by judging from the comments. How and when will we find out?

**Southern LINC, Southern Telecom, Inc., and Southern Company Services, Inc.**

In their comments, it is stated:

> A number of radio amateurs have commented that interference from electric power lines is difficult to identify and correct, and they suggest that Access BPL will be of the same type. These concerns are unfounded, however, because there are a multitude of locations on a normally functioning electric power system where RF noise can be detected by sensitive amateur radio receivers. By contrast, Access BPL will involve identifiable RF devices on discrete power lines and operating on specific radio frequencies or bands of frequencies.

This just isn't true if the modulation scheme is digital in nature. In my original NOI comments[5], I showed that any wideband digital modulation is noise-like and requires the same measurement methods applicable to noise signals. To achieve the data rates promised by BPL developers, it appears that quadrature amplitude modulation (QAM) and orthogonal frequency division multiplexing (OFDM), or some close derivation of the same, are emerging as the technologies of choice (re: POWERWAN's NOI comments). But what is this reference to 'specific frequencies'? It has already been established that Access BPL will occupy the *entire range* from 2-30 MHz (the upper frequency limit being variously stated as 40, 50, or as high as 80 MHz depending on the manufacturer), ***which classifies it as a wideband signal***. OFDM, by definition, requires multiple modulated carriers spread over a wide swath of spectrum to simultaneously attain both its high data rate and its immunity to interference from other BPL devices operating in the same band. That can in no way be termed operating on 'specific frequencies'.

Simple listening tests in BPL test neighborhoods have already clearly demonstrated the wideband nature of the BPL signal. In one test, a communications receiver is shown being swept over various HF bands between 5 and 21 MHz with almost constant noise, carriers and interference being measured[6]. Tracking down and identifying BPL interference will be every bit as difficult as tracking down the power line noise that Southern LINC et al correctly characterize as confusing and difficult to locate. (Incidentally, Southern LINC refers to a 'normally functioning electric system', ostensibly to gain acceptance as " normal" any interference caused by BPL, but the issue at hand, of course, is tracking down interference that is outside the

norm. Noise and harmful interference from Access BPL are clearly outside what has been the norm throughout the history of the power grid.)

Southern LINC et al continue: they state that Access BPL 'will involve identifiable RF devices' operating on defined portions of the power lines. How exactly will they be identified? And exactly how do you introduce a signal onto the power lines and confine it to a specific part of the lines? We aren't actually told; we are left to surmise the mechanism by ourselves. The technological ignorance is almost laughable. As anyone working for a utility company in interference abatement will tell you, noise isn't *confined* to a particular power pole or high voltage line. Noise is an electromagnetic signal. As such, they *travel*. They even hop from one portion of the grid to another, through coupling or re-radiation. I myself have done a fair amount of power line interference location, using direction finding techniques and so forth, and have encountered situations where a malfunctioning street light places noise on the power line that can be heard equally as strong a quarter-mile or more away, and with increasing distance from the source the ambiguity in ascertaining the direction of the source grows, making the location effort harder and harder.

## Main.net

Main.net's field trials have consisted of tests in a total of *three* homes[7], but evidently the three homes were in geographically different locations. It isn't fully clear from their comments, but ostensibly at any one time their tests were on only one residence using Access BPL and/or In-House BPL. In other words, they turned on BPL to *one* home and decided that there was no interference and declared the test a success. Does this constitute a realistic test? Wouldn't a more realistic trial be to involve multiple residences, or an entire apartment building or buildings, or multiple businesses? At that point, any harmful interference present will be at a level that will involve multiple problems at multiple locations with mutiple interference reports, multiple radios, televisions, shortwave receivers, scanners, security systems, public service communications, etc. possibly being interfered with, and multiple consumers making multiple phone calls to FCC, to utilities, to equipment manufacturers, to neighbors, to city halls, and to whomever else they deem responsible for the interference.

## Conclusions

In the physical world, if one does something, certain things will happen as a result: Placing RF signals on the power

lines causes them to radiate. Saying that they won't doesn't stop them from doing so! Asserting that a wideband signal occupies 'specific frequencies' doesn't make it so. It is still a wideband signal and will act like one!

Because of the mountain of evidence showing not just the potential, but the *actual* interference now being experienced in BPL trial neighborhoods, with scarcely any hard data refuting this evidence, I respectfully ask FCC to place a grave responsibility on BPL providers to speak in defense of their claims against this evidence. Unless and until hard data are made public, in the interest of full disclosure, how can any informed decision be made by FCC? Judging solely from the facts on the table at this moment, the evidence is overwhelming, and BPL stands convicted as a poorly-conceived technology whose proponents are too much hype and too little engineering and mathematical rigor.

**Respectfully Submitted,**

**Alfred T. Lorona**
**Arcadia, CA**
**al_lorona@agilent.com**

**REFERENCES**

1. http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6514284577
2. http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6514284561
3. http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6514284561
4. As a representative example, see:
http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6514284573
5. http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6514284705
6. http://216.167.96.120/BPL_Trial-web.mpg
7. http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6514284546